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ABSTRACT

The paper describes a pilot project in which 17 hearing impaired adolescents are participating in a program to improve thinking skills via the Instrumental Enrichment (IE) approach. IE focuses on concepts by suggesting alternative strategies by which the learner can arrive at the objective, thus allowing for opportunities to reflect on one's own thinking processes. Three separate data collections measured learning of the training task and generalization to a specific curricular situation as well as to other situations. Analysis of Raven's Standard Progressive Matrices, Reading Comprehension Subtest of the Stanford Achievement Test--Hearing Impaired Version, and problem-solving interviews supported the use of IE as a way to promote logical and abstract thinking, to help develop prerequisite skills for reading comprehension, and to carry over problem solving skills to life experiences. Program evaluation findings have revealed high student motivation in problem solving tasks, increases in peer cooperation, and greater interests in process over product. (CL)

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CAN THINKING SKILLS BE INCORPORATED INTO A CURRICULUM? A DEMONSTRATION

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Teachers who work with hearing-impaired adolescents frequently express deep concern and frustration about some of their students' serious deficiencies in problem-solving skills as evident in both classroom discussions and written work. Previous studies have established these concerns as valid. Hearing-impaired children have demonstrated certain specific cognitive deficiencies in such areas as: memory (Karchmer & Belmont, 1976), concept application (Meadow, 1980), opposition (Furth, 1964; Meadow, 1980), analogic reasoning (Meadow, 1980), superordinate reasoning (Johnson, 1981), and classification (Best & Roberts, 1975). However, hearing-impaired learners have been shown to perform as well as hearing children on cognitive tasks such as understanding parts vs. whole (Furth, 1964; Meadow, 1980). Thus we see normal performance by hearing-impaired children on some cognitive tasks and not others.

If we accept the evidence that some cognitive deficiencies do exist for hearing-impaired individuals but no evidence suggests less than the normal range of intellectual potential among the hearing-impaired, it is apparent that a cognitive intervention program used in an educational setting might promise improvement of these skills.

Instrumental Enrichment (I.E.) was developed in response to the need for mediated learning experiences to facilitate the development of thinking skills among culturally disadvantaged groups emigrating to Israel. A mediated learning experience is a process by which another person assists a learner to master a particular skill or concept, not by directly telling it to the learner, but by suggesting alternative strategies by which the learner himself can arrive at the

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objective. Originally developed by Reuven Feuerstein (1978, 1980), I.E. consists of content-free paper-and-pencil activities relating to fourteen specific cognitive functions. This program provides an excellent tool for instruction in relation to the results of those studies cited earlier for the following reasons:

a. It gives the students repeated opportunities to reflect on their own thinking processes.

b. I.E. develops the prerequisites for learning and does not assume that those prerequisites already exist in the learner.

c. I.E. does not assume that the student will automatically generalize the skill to other areas; instead, a critical element in the daily instructional sequence for I.E. in the "Bridging" exercise, in which the teacher overtly and actively promotes transfer by the student of skills to both real-life and curricular situations.

A strong validation of the importance of training students in the intellectual skills is made by Sternberg (1983); he lists several criteria which any worthwhile training program should meet. Among them is the importance of training students in strategies, and he specifically mentions Feuerstein's Instrumental Enrichment as a successful example of such a program.

A special two-year pilot project is underway at the Model Secondary School for the Deaf (see Martin, et al., 1983). A control group of seventeen students and an experimental group of ten students are being studied using measures of cognitive functioning to assess the success of this systematic intervention program, Instrumental Enrichment. The experimental and control groups were matched on the basis of age, sex, degree of hearing loss and reading ability. Three questions needed to be answered in an evaluation of this effort. First, can the student learn the training task itself? Second, can the students generalize

the training to a specific curricular situation? Third, can the training generalize to other situations? To answer these questions, three separate data collections were planned.

The Raven's Standard Progressive Matrices was selected to assess general intellectual capacity by requiring an individual to solve a series of increasingly difficult abstract design problems. The test has a multiple-choice, untimed format which can be given individually or in small groups. The Raven's was administered to both the experimental and control subjects. Also selected was the Stanford Achievement Test--Hearing-Impaired Version, Reading Comprehension subtest which used multiple choice responses to written questions to assess an individual's ability to construct a coherent interpretation of an extended prose passage, as well as measuring specific decoding skills such as finding the main idea or locating supporting details. It is timed and intended to be given in group setting. All Model Secondary School for the Deaf (MSSD) students were given the entire test battery. Finally, "problem-solving interviews" were conducted to examine the use of problem-solving strategies. Each experimental and control subject was interviewed using a prescribed format. The students were asked to respond to three questions asked by hearing-impaired research assistants who qualified as users of American Sign Language. The three questions were:

1. Suppose you are responsible for planning a trip for a class to go from MSSD to downtown Washington, DC for a whole day to visit the Capitol building. What steps would you take? Please list the things you would have to plan.

2. If you had to tell someone exactly how to walk from the Auditorium at MSSD to the Cafeteria, what directions would you give to him or her?

3. You are in a restaurant downtown with an MSSD friend. After dinner, your friend becomes sick from the food at the restaurant. He can't walk, and he is in pain. The restaurant manager refuses to help you. What would you do?

The students were videotaped as they responded to these questions.

Since there are no suitable norms for hearing-impaired children for the Raven's, simple frequency of correct responses was used as the best estimate of change in ability as the result of training. While no statistically significant differences were found between the experimental and control groups using a one-way variance on the basis of the number of items correctly completed on the Raven's, a clear trend was found in the data when individual score changes were examined. Testing of the experimental group at the end of the second year of training in I.E. instruction revealed even more impressive results. Compared with the original test scores on the Raven's in the fall of 1981, the I.E. group had gained an average of 6.3 points while the control group gained 2.9 points.

The results of the Reading Comprehension subtest of the Stanford Achievement Test--Hearing-Impaired Version were analyzed for the changes in the experimental group between November 1981 and November 1982 and also for differences between the experimental and control groups in November 1982. The experimental group showed a higher, though statistically nonsignificant, mean scaled score (154.1) than the control group (150.6) on the posttest of November 1982. A test for significance of difference within each group between pre and post testing, however, showed a significant increase for the experimental group ($p < .05$), while no such difference was found within the control group.

In an analysis of the "problem-solving interviews," a trend in favor of the experimental group was indicated with regard to practicality of the solution and completeness of the solution to the problem situation. Each subject was interviewed by a hearing-impaired adult before and after the I.E. experience. From these videotaped interviews, three sets of videotapes were prepared for analysis. Each videotape contained one set of responses (i.e., pre and post) for each individual in the experimental and control groups. Once again some of the experimental group students were able to generalize from I.E. to the problem

solving situation, suggesting that the program impacts on students in varying degrees (Kluwin, 1982).

These results support the fact that I.E. is an intervention program that promotes logical and abstract thinking, as was noted on the individual growth in scores on the Raven's Progressive Standard Matrices. In addition, the trend in favor of the experimental group when comparing pre and post Stanford Achievement Test--Hearing-Impaired Version Reading Comprehension subtest scores within the experimental and control groups, indicates that the program is contributing some positive impact toward the development of prerequisite skills for reading comprehension. The trend in favor of the experimental group with regard to the "problem-solving interview" also indicates the usefulness of the program, as the students trained in I.E. were able to carry over strategies for problem-solving into a life experience.

Teachers who are experienced with training in I.E. and in teaching I.E. to deaf students are noticing new approaches and marked achievement in the course work of the experimental group who are now into their second year of the training program. The same systematic approaches applied to problem-solving are being transferred to their class assignment. The following points summarize the I.E. teachers' point of view:

1. The program has created in the students an increased awareness of the importance of learning and its relation to everyday life. The constant use of mediation and bridging techniques during the program has contributed to the students' ability to transfer and apply concepts to varied situations.

2. The program reduces student fear of failure since it emphasizes involvement with the classroom situation (mediation, group discussions, etc.) rather than presenting ideas that are limited to singular judgment.

3. The program requires that students explore the "gray zone" in the sense that "black-white" or dichotomous thinking no longer is acceptable.

4. Students develop a systematic cause-effect approach to examining their own errors, as opposed to repetitive trial-and-error behavior.

5. The program requires the teacher to depart from the "safe zone" (i.e., questioning that requires a yes-no answer) and present thought-provoking questions that cannot be answered without being carefully thought out. In essence the teacher, instead of presenting information, facilitates the students' thinking as a means of creating their own path towards the acquisition of knowledge.

6. Participation in the program also deepens teacher preparation of lessons in subject matter areas.

At the end of the second pilot year, some important and consistent effects can be reported for the students receiving I.E. instruction:

1. Hearing-impaired students now approach problem-solving situations in the curriculum more systematically and with less impulsivity.

2. Students have improved in their ability to analyzed the component parts of a problem.

3. Students have improved in their understanding of the reasons behind required assignments in English and Mathematics.

4. Significant growth in vocabulary usage has been observed in sign language; no significant evidence of growth in written application of these words has been observed as yet.

5. Higher student motivation in problem-solving tasks has been noted by teachers.

6. Students are now working with peers in problem-solving tasks with less simplistic criticism of peers' work as either right or wrong; rather,

they appear better able to analyze individual components of peers' work and to judge which elements are right and wrong and why.

7. Important increases have been clearly noted in peer cooperation and in students' positive attitudes toward criticism.

8. Student interview results indicate a statistically significant improvement for the experimental group in practicality, completeness, organization, and systematic planning in their solutions to problems (Kluwin, 1982, p. 8).

9. The teacher observation checklist indicated that the experimental students more frequently were able to describe several strategies to solve a problem, and defended their opinions on the basis of logical evidence.

10. Students have become less obsessed with the end-results or terminal behavior of an objective and more interested in the means (process) by which the objective is reached.

11. Preliminary data indicate a trend in the improvement of reading comprehension in experimental students.

Systematic cognitive intervention for adolescent hearing-impaired learners is demonstrated to be effective in a classroom setting, provided the appropriate materials and adequate teacher training are available. It has now been demonstrated that hearing-impaired students can indeed improve their cognitive skills and that adolescence, while later in their developmental cycle, is clearly not too late for effective intervention in cognitive strategies.

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